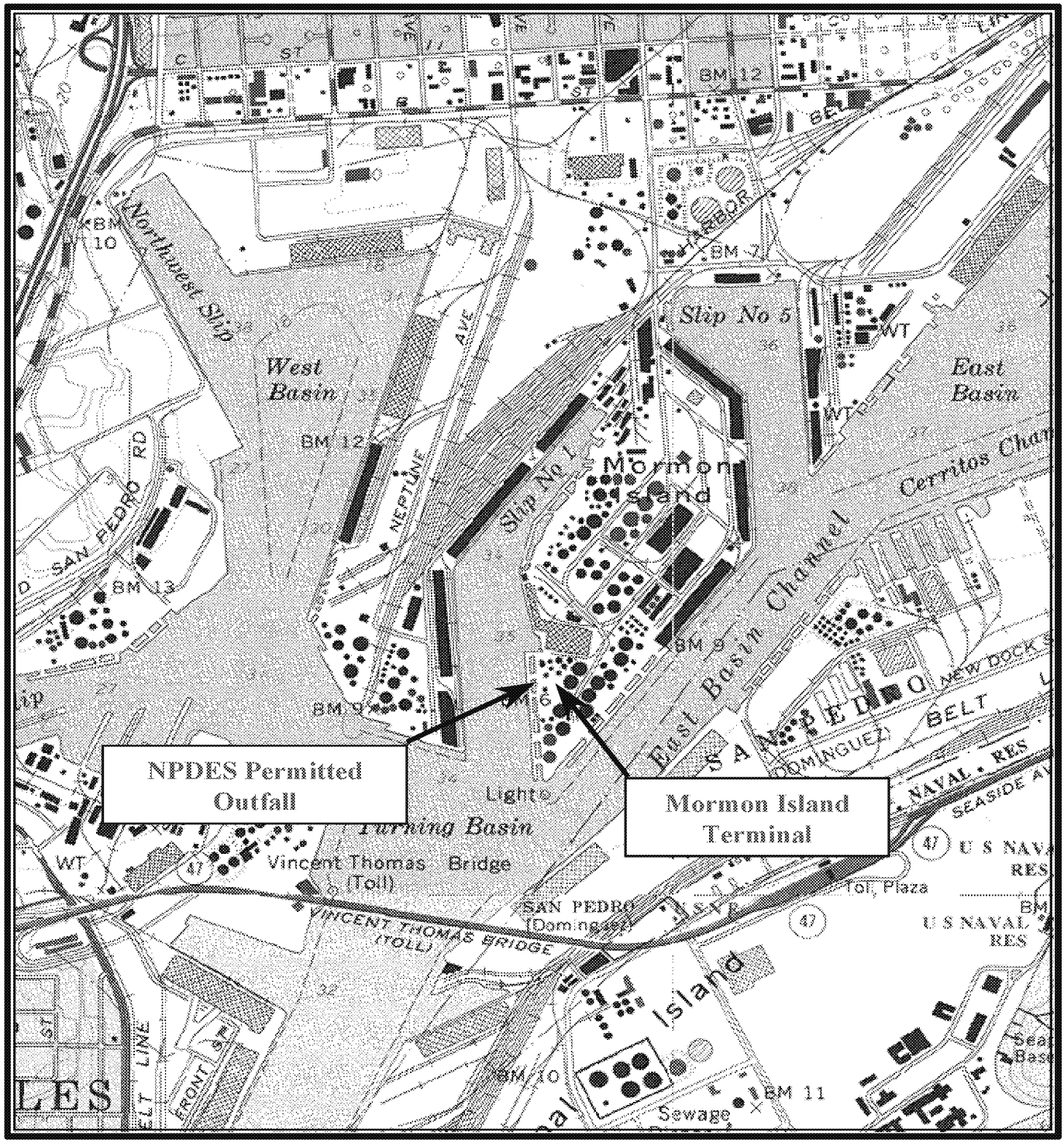
*FIGURE 1*
**VICINITY TOPOGRAPHIC MAP**

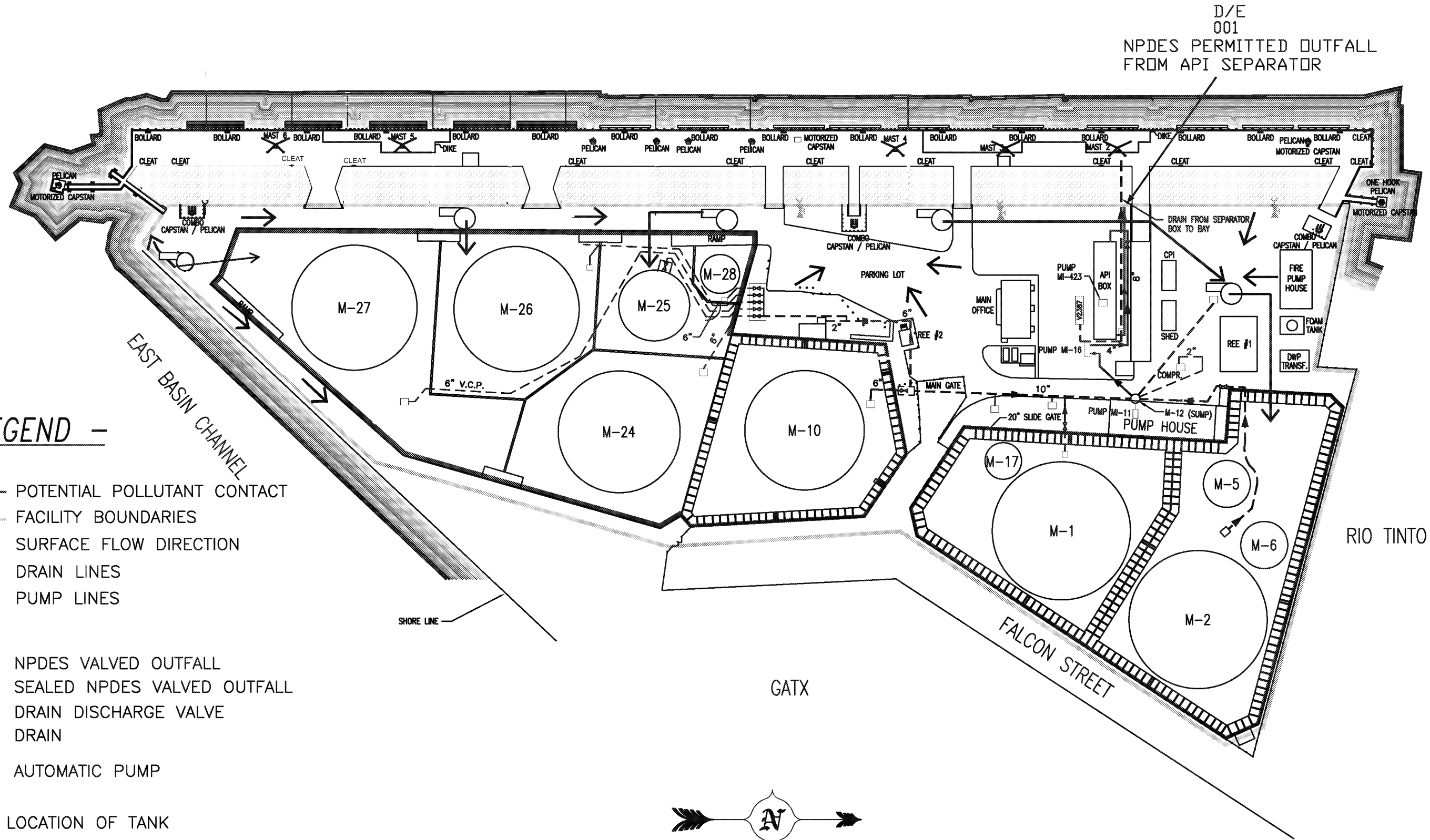



Legend

| | | | | |
|---|---|---|---|---|
| WGR Southwest, Inc.<br>11021 Winners Circle, Suite 101<br>Los Alamitos, CA 90720 | SOPUS Mormon Island Terminal<br>Site Topography Map<br>Port of Los Angeles Berths 167 - 168 | | | Figure<br>1 |
| | DATE<br>1/24/00 | PROJECT NUMBER<br>094.EQL | DWN BY<br>JMT | DWG # |

# FIGURE 2:

# SITE MAP - STORM WATER FLOW, OUTFALL AND FACILITY INDUSTRIAL ACTIVITIES




## - LEGEND -

- POTENTIAL POLLUTANT CONTACT
- FACILITY BOUNDARIES
- SURFACE FLOW DIRECTION
- DRAIN LINES
- PUMP LINES
- NPDES VALVED OUTFALL
- SEALED NPDES VALVED OUTFALL
- DRAIN DISCHARGE VALVE
- DRAIN
- AUTOMATIC PUMP
- M-5 LOCATION OF TANK
- D/E DISCHARGE POINT/ MONITORING LOCATION

N

NOTE:

1. NO POTENTIAL EROSION LOCATIONS AT SITE.
2. THE AREA BY REE #1 IS THE OLD M14 LEVY VALVE AREA

| REF_NO | REF_D | NO | DATE | REV_D | NAME | CHK | ENGR | APP | NO | DATE | REV_D | NAME | CHK | ENGR | APP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REF_NO | REF_D | NO | DATE | REV_D | NAME | CHK | ENGR | APP | NO | DATE | REV_D | NAME | CHK | ENGR | APP |
| REF_NO | REF_D | NO | DATE | REV_D | NAME | CHK | ENGR | APP | NO | DATE | REV_D | NAME | CHK | ENGR | APP |
| REF_NO | REF_D | NO | DATE | REV_D | NAME | CHK | ENGR | APP | NO | DATE | REV_D | NAME | CHK | ENGR | APP |
| REF_NO | REF_D | NO | DATE | REV_D | NAME | CHK | ENGR | APP | NO | DATE | REV_D | NAME | CHK | ENGR | APP |
| REF_NO | REF_D | NO | 03/24/2011 | Update NPDES Outfalls | AHO | CHK | ENGR | APP | NO | DATE | REV_D | NAME | CHK | ENGR | APP |

| DWG. NUMBER | REFERENCE DRAWING DESCRIPTION | REV. NO. | DATE | REVISION DESCRIPTION | BY | CHK. | ENGR | APP. | REV. NO. | DATE | REVISION DESCRIPTION | BY | CHK. | ENGR | APP. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Shell Oil Products US

| FORMER DRAWING NUMBER | LOCATION CODE |
|---|---|
| OLDWG_NO | LOCATION |

Shell Oil Products US
Mormon Island Terminal
Berth 168
Wilmington, CA 90744
COUNTY: Los Angeles

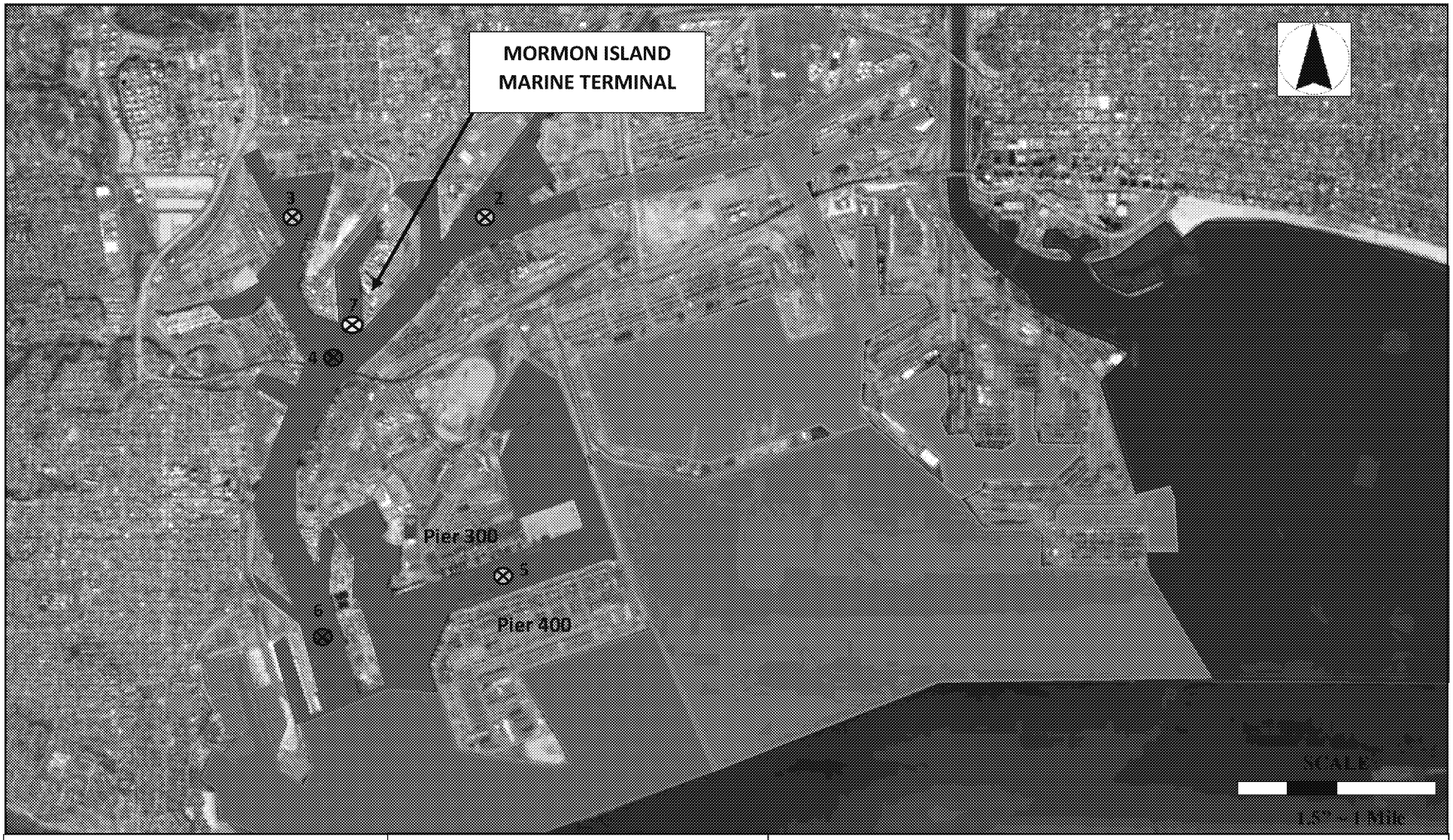
| SCALE: | DATE: 03/24/11 | REV. |
|---|---|---|
| DRAWN: | | |

DESC

DATESTAMP

# FIGURE 3:

# MONITORING AND SAMPLING STATIONS




**Shell Oil Products US**

Mormon Island Terminal

Figure 3 – Harbor Toxics TMDL Compliance Monitoring Locations

| Water Body Regions: | Monitoring Locations: |
|---|---|
| Los Angeles Inner Harbor | ⊗ Stations 02, 03 and 05 (Water Column/TSS Sample Locations) |
| Los Angeles Outer Harbor | ● Stations 04 and 06 (Water Column/TSS, and Sediment Sample Locations) |
| Long Beach Inner Harbor | ⊗ Station 7 (Fish Tissue Sampling Location) |
| Long Beach Outer Harbor | |
| East San Pedro Bay | |

WGR

# APPENDIX A:

# SAMPLE CONTAINERS AND HOLDING CONDITIONS

| Appendix A: Sample Containers and Holding Conditions[1] | | | |
|---|---|---|---|
| **Parameter** | **Container Type / Volume** | **Holding Time** | **Preservative** |
| **Water/TSS Samples[2]** | | | |
| pH | N/A | 15 minutes | N/A |
| Dissolved Oxygen | N/A | 15 minutes | N/A |
| Salinity | 1 - 125 ml HDPE | 28 days | Cool ≤6°C |
| Total Suspended Solids | 2- 1 L HDPE | 7 days | Cool ≤6°C |
| Metals | 1- 250 ml HDPE | 180 days | HNO3 ; Cool ≤4°C |
| Pesticides | 1 - 1L Amber Glass | 7 days | Cool ≤6°C |
| PCBs | 1 - 1L Amber Glass | 7 days | Cool ≤6°C |
| **Sediment Samples** | | | |
| TOC | 1- 4-oz glass | 28 days | Cool ≤4°C |
| Metals | 1 - 4-oz glass with teflon lid | 14 days | Cool ≤6°C |
| | | 12 months | Freeze ≤ -20°C |
| Pesticides | 1 - 4-oz glass with teflon lid | 14 days | Cool ≤4°C |
| PAHs | 1 - 4-oz glass with teflon lid | 14 days | Cool ≤4°C |
| PCBs | 1 - 4-oz glass with teflon lid | 14 days | Cool ≤4°C |
| Benthic Community Effect[3] | 1 – 0.5-gallon plastic container | - | Cool ≤6°C |
| Sediment Toxicity | 4 - 1L polyethylene jar with teflon lid | 14 days | Cool ≤4°C |
| **Fish Tissue Samples** | | | |
| Pesticides | Polyethylene bag or 1 - 16 oz glass jar | 14 days to extraction | Cool ≤6°C |
| | | 1 year to extraction; samples must be extracted within 14 days of thawing | Freeze ≤ -20°C |
| | | 40 days after extraction | Cool ≤6°C |
| PCBs | Polyethylene bag or 1 - 16 oz glass jar | None | Cool ≤6°C within 24 hours, then Freeze - ≤20°C |

1 – Sample preservation is intended as a guidance only. The selection of sample container and sample volume may vary per contracted / subcontracted laboratories.

2 – Water column analysis of flow, temperature, dissolved oxygen, and pH shall be conducted in the field using the appropriate calibrated field equipment. A record of the calibration and the field readings shall be documented in the appropriate form.

3 – Samples for benthic community effect are preserved in the field by maintaining samples cold. Once submitted to the laboratory, samples are stored in formalin for at least 72 hours and then samples are maintained in 70% ethanol. Samples can be stored for up to 1 year before having to refresh the ethanol.

# APPENDIX B

# ANALYTICAL METHODS, REPORTING LIMITS AND METHOD DETECTION LEVELS

| Appendix B: Analytical Methods, Reporting Limits and Method Detection Levels | | | | |
|---|---|---|---|---|
| **Parameter** | **Analytical Method** | **Method Detection Levels** | **Reporting Limit** | **Units** |
| **WATER COLUMN / TSS ANALYSIS** | | | | |
| Copper | USEPA 6020 | 0.00297 | 0.005 | mg/L |
| Lead | USEPA 6020 | 0.00133 | 0.003 | mg/L |
| Zinc | USEPA 6020 | 0.00256 | 0.01 | mg/L |
| **DDT** | | | | |
| o'p-DDT | USEPA 608 | 0.001 | 0.002 | ug/L |
| p,p'-DDT | USEPA 608 | 0.0005 | 0.0013 | ug/L |
| **PCBs** | | | | |
| PCB008 | EPA 8270C SIM PCB Congeners | 0.00051 | 0.0040 | ug/L |
| PCB018 | EPA 8270C SIM PCB Congeners | 0.00046 | 0.0020 | ug/L |
| PCB028 | EPA 8270C SIM PCB Congeners | 0.00053 | 0.0020 | ug/L |
| PCB044 | EPA 8270C SIM PCB Congeners | 0.00071 | 0.0020 | ug/L |
| PCB052 | EPA 8270C SIM PCB Congeners | 0.00056 | 0.0020 | ug/L |
| PCB066 | EPA 8270C SIM PCB Congeners | 0.00040 | 0.0020 | ug/L |
| PCB101 | EPA 8270C SIM PCB Congeners | 0.00050 | 0.0020 | ug/L |
| PCB105 | EPA 8270C SIM PCB Congeners | 0.00047 | 0.0020 | ug/L |
| PCB118 | EPA 8270C SIM PCB Congeners | 0.00050 | 0.0020 | ug/L |
| PCB128 | EPA 8270C SIM PCB Congeners | 0.00043 | 0.0020 | ug/L |
| PCB 138 | EPA 8270C SIM PCB Congeners | 0.00060 | 0.0040 | ug/L |
| PCB 153 | EPA 8270C SIM PCB Congeners | 0.00069 | 0.0040 | ug/L |
| PCB170 | EPA 8270C SIM PCB Congeners | 0.00042 | 0.0020 | ug/L |
| PCB180 | EPA 8270C SIM PCB Congeners | 0.00060 | 0.0020 | ug/L |
| PCB187 | EPA 8270C SIM PCB Congeners | 0.00043 | 0.0020 | ug/L |
| PCB195 | EPA 8270C SIM PCB Congeners | 0.00075 | 0.0020 | ug/L |
| PCB206 | EPA 8270C SIM PCB Congeners | 0.00043 | 0.0020 | ug/L |
| PCB209 | EPA 8270C SIM PCB Congeners | 0.0013 | 0.0020 | ug/L |

1 - Reporting Limits (RLs) and Method Detection Levels (MDLs) provided are those provided by Eurofins Laboratory for the water column analysis required under the Harbor Toxics TMDL Monitoring Program

| Appendix B: Analytical Methods, Reporting Limits and Method Detection Levels[1] | | | | |
|---|---|---|---|---|
| **Parameter** | **Analytical Method** | **Method Detection Levels** | **Reporting Limit** | **Units** |
| **SEDIMENT ANALYSIS** | | | | |
| Total Organic Carbon | USEPA 9060A/SM5310B | 0.1 | 0.1 | % |
| Percent Fines | ASTM D442/SM2560 | 0.1 | 0.1 | % |
| **Metals** | | | | |
| Cadmium | EPA 6020 | 0.0572 | 0.1 | mg/kg |
| Copper | EPA 6020 | 0.0419 | 0.1 | mg/kg |
| Lead | EPA 6020 | 0.0659 | 0.1 | mg/kg |
| Mercury | EPA 7471A | 0.00587 | 0.02 | mg/kg |
| Zinc | EPA 6020 | 0.795 | 1.00 | mg/kg |
| **PAHs** | | | | |
| Acenaphthene | EPA 8270C SIM PAHs | 0.0024 | 0.01 | mg/kg |
| Anthracene | EPA 8270C SIM PAHs | 0.0018 | 0.01 | mg/kg |
| Biphenyl | EPA 8270C SIM PAHs | 0.0019 | 0.01 | mg/kg |
| Naphthalene | EPA 8270C SIM PAHs | 0.0035 | 0.01 | mg/kg |
| 2,6-dimethylnaphthalene | EPA 8270C SIM PAHs | 0.0017 | 0.01 | mg/kg |
| Fluorene | EPA 8270C SIM PAHs | 0.0031 | 0.01 | mg/kg |
| 1-methylnaphthalene | EPA 8270C SIM PAHs | 0.0023 | 0.01 | mg/kg |
| 2-methylnaphthalene | EPA 8270C SIM PAHs | 0.0023 | 0.01 | mg/kg |
| 1-methylphenanthrene | EPA 8270C SIM PAHs | 0.0025 | 0.01 | mg/kg |
| Phenanthrene | EPA 8270C SIM PAHs | 0.0022 | 0.01 | mg/kg |
| Benzo(a)anthracene | EPA 8270C SIM PAHs | 0.0022 | 0.01 | mg/kg |
| Benzo(a)pyrene | EPA 8270C SIM PAHs | 0.0018 | 0.01 | mg/kg |
| Benzo(e)pyrene | EPA 8270C SIM PAHs | 0.002 | 0.01 | mg/kg |
| Chrysene | EPA 8270C SIM PAHs | 0.0022 | 0.01 | mg/kg |
| Dibenz(a,h)anthracene | EPA 8270C SIM PAHs | 0.002 | 0.01 | mg/kg |
| Fluoranthene | EPA 8270C SIM PAHs | 0.0018 | 0.01 | mg/kg |
| Perylene | EPA 8270C SIM PAHs | 0.0024 | 0.01 | mg/kg |
| Pyrene | EPA 8270C SIM PAHs | 0.0022 | 0.01 | mg/kg |
| **Pesticides** | | | | |
| Alpha Chlordane | EPA 8081A | 0.41 | 1 | ug/kg |
| Gamma Chlordane | EPA 8081A | 0.89 | 2 | ug/kg |
| Trans Nonachlor | EPA 8081A | 0.27 | 1 | ug/kg |
| Dieldrin | EPA 8081A | 0.069 | 0.2 | ug/kg |
| o,p'-DDE | EPA 8270C PEST-SIM | 0.035 | 0.2 | ug/kg |
| o,p'-DDD | EPA 8270C PEST-SIM | 0.076 | 0.2 | ug/kg |
| o'p-DDT | EPA 8270C PEST-SIM | 0.062 | 0.2 | ug/kg |
| p,p'-DDD | EPA 8270C PEST-SIM | 0.04 | 0.2 | ug/kg |
| p,p'-DDE | EPA 8270C PEST-SIM | 0.04 | 0.2 | ug/kg |
| p,p'-DDT | EPA 8270C PEST-SIM | 0.053 | 0.2 | ug/kg |
| **PCBs** | | | | |
| PCB008 | EPA 8270C SIM PCB Congeners | 0.077 | 0.4 | ug/kg |
| PCB018 | EPA 8270C SIM PCB Congeners | 0.065 | 0.2 | ug/kg |
| PCB028 | EPA 8270C SIM PCB Congeners | 0.069 | 0.2 | ug/kg |

| Parameter | Analytical Method | Method Detection Levels | Reporting Limit | Units |
|---|---|---|---|---|
| PCB044 | EPA 8270C SIM PCB Congeners | 0.15 | 0.2 | ug/kg |
| PCB052 | EPA 8270C SIM PCB Congeners | 0.19 | 0.2 | ug/kg |
| PCB066 | EPA 8270C SIM PCB Congeners | 0.12 | 0.2 | ug/kg |
| PCB101 | EPA 8270C SIM PCB Congeners | 0.044 | 0.2 | ug/kg |
| PCB105 | EPA 8270C SIM PCB Congeners | 0.053 | 0.2 | ug/kg |
| PCB118 | EPA 8270C SIM PCB Congeners | 0.035 | 0.2 | ug/kg |
| PCB128 | EPA 8270C SIM PCB Congeners | 0.12 | 0.2 | ug/kg |
| PCB 138 | EPA 8270C SIM PCB Congeners | 0.35 | 0.4 | ug/kg |
| PCB 153 | EPA 8270C SIM PCB Congeners | 0.35 | 0.4 | ug/kg |
| PCB170 | EPA 8270C SIM PCB Congeners | 0.11 | 0.2 | ug/kg |
| PCB180 | EPA 8270C SIM PCB Congeners | 0.092 | 0.2 | ug/kg |
| PCB187 | EPA 8270C SIM PCB Congeners | 0.1 | 0.2 | ug/kg |
| PCB195 | EPA 8270C SIM PCB Congeners | 0.06 | 0.2 | ug/kg |
| PCB206 | EPA 8270C SIM PCB Congeners | 0.12 | 0.2 | ug/kg |
| PCB209 | EPA 8270C SIM PCB Congeners | 0.061 | 0.2 | ug/kg |
| **Sediment Toxicity & Benthic Community Effects** | | | | |
| Sediment Toxicity analysis shall be performed per the SQO-Part 1 guidelines using percent of control survival as metric. Refer to Table 4, Sediment Toxicity Categorization Values, detailed in the SQO-Part 1 document. | | | | |
| The Benthic Community Condition shall be assessed through the use of 4 benthic indices to determine the benthic index categorization value and associated disturbance. Refer to Table 5, Benthic Index Categorization Values, of the SQO Part-1 document. | | | | |

1 - Reporting Limits (RLs) and Method Detection Levels (MDLs) provided are those provided by Eurofins Laboratory for the analyses chosen for the chemical analytes as required in Attachment A of the SQO - Part 1

| Appendix B: Analytical Methods, Reporting Limits and Method Detection Levels[1] | | | | |
|---|---|---|---|---|
| **Parameter** | **Analytical Method** | **Method Detection Levels** | **Reporting Limit** | **Units** |
| **FISH TISSUE ANALYSIS** | | | | |
| Chlordane | EPA 8081A | 5.30 | 10.0 | ug/kg |
| Dieldrin | EPA 8081A | 0.44 | 1.0 | ug/kg |
| Toxaphene | EPA 8081A | 9.00 | 20.0 | ug/kg |
| **DDT** | | | | |
| o'p-DDT | EPA 8081A | 0.31 | 1.0 | ug/kg |
| p,p'-DDT | EPA 8081A | 0.44 | 1.0 | ug/kg |
| **PCBs** | | | | |
| PCB008 | EPA 8270C SIM PCB Congeners | 0.14 | 0.40 | ug/kg |
| PCB018 | EPA 8270C SIM PCB Congeners | 0.071 | 0.20 | ug/kg |
| PCB028 | EPA 8270C SIM PCB Congeners | 0.034 | 0.20 | ug/kg |
| PCB044 | EPA 8270C SIM PCB Congeners | 0.087 | 0.20 | ug/kg |
| PCB052 | EPA 8270C SIM PCB Congeners | 0.063 | 0.20 | ug/kg |
| PCB066 | EPA 8270C SIM PCB Congeners | 0.10 | 0.20 | ug/kg |
| PCB101 | EPA 8270C SIM PCB Congeners | 0.098 | 0.20 | ug/kg |
| PCB105 | EPA 8270C SIM PCB Congeners | 0.055 | 0.20 | ug/kg |
| PCB118 | EPA 8270C SIM PCB Congeners | 0.084 | 0.20 | ug/kg |
| PCB128 | EPA 8270C SIM PCB Congeners | 0.10 | 0.20 | ug/kg |
| PCB 138 | EPA 8270C SIM PCB Congeners | 0.094 | 0.40 | ug/kg |
| PCB 153 | EPA 8270C SIM PCB Congeners | 0.17 | 0.40 | ug/kg |
| PCB170 | EPA 8270C SIM PCB Congeners | 0.063 | 0.20 | ug/kg |
| PCB180 | EPA 8270C SIM PCB Congeners | 0.042 | 0.20 | ug/kg |
| PCB187 | EPA 8270C SIM PCB Congeners | 0.084 | 0.20 | ug/kg |
| PCB195 | EPA 8270C SIM PCB Congeners | 0.12 | 0.20 | ug/kg |
| PCB206 | EPA 8270C SIM PCB Congeners | 0.19 | 0.20 | ug/kg |
| PCB209 | EPA 8270C SIM PCB Congeners | 0.15 | 0.20 | ug/kg |

1 - Reporting Limits (RLs) and Method Detection Levels (MDLs) provided are those provided by Eurofins Laboratory for the fish tissue analysis required under the Harbor Toxics TMDL Monitoring Program

# APPENDIX C

# HARBOR TOXICS TMDL TARGETS

# Appendix C: Harbor Toxics TMDL Targets[1]

| Receiving Water Column Waste Load Allocations | |
|---|---|
| **Parameter** | **Greater Harbor Waters** |
| **Metals (ug/L)** | |
| Copper | 3.73 |
| Lead | 8.52 |
| Zinc | 85.6 |
| **Organics (ug/L)** | |
| 4'4 DDT | 0.00059 |
| Total PCBs | 0.00017 |

| Sediment Targets | |
|---|---|
| **Parameter** | **Target (mg/kg)** |
| **Metals** | |
| Cadmium | 1.2 |
| Copper | 34 |
| Lead | 46.7 |
| Mercury | 0.15 |
| Zinc | 150 |
| **Organics** | |
| **Parameter** | **Marine Sediment (ug/kg)** |
| Chlordane, total | 0.5 |
| Dieldrin | 0.02 |
| Toxaphene | 0.1 |
| Total PCBs | 22.7 |
| Benzo[a]anthracene | 261 |
| Benzo[a]pyrene | 430 |
| Chrysene | 384 |
| Pyrene | 665 |
| 2-methylnapththalene | 201 |
| Dibenz[a,h] anthracene | 260 |
| Phenanthrene | 240 |
| Hi MW PAHs | 1700 |
| Lo MW PAHs | 552 |
| Total PAHs | 4022 |
| Total DDT | 1.58 |

| Fish Tissue Targets | |
|---|---|
| **Parameter** | **Target (ug/kg)** |
| **Organics** | |
| Chlordane | 5.6 |
| Dieldrin | 0.46 |
| Total DDT | 21 |
| Total PCBs | 3.6 |
| Total PAHs | 5.47 |
| Toxaphene | 6.1 |

1 – Harbor Toxics TMDL Targets are designated in Attachment A to Resolution No. R11-008 (Appendix H).

# APPENDIX D:

# CHAIN OF CUSTODY FORMS

# Shell Oil Products US Chain Of Custody Record

Eurofins
7440 Lincoln Way
Garden Grove, CA 92841-1432
(714) 895-5494 (714) 894-7501 fax

**Shell Representative to be invoiced:**
Shell Oil Products US
Attention: Rick Roper
20945 S. Wilmington Avenue
Carson, CA 90810
(310) 816-2060

COC MI - Water Column
**Harbor Toxics TMDL Monitoring Program**

DATE: _____

PAGE: ___1___ of ___1___

CONSULTANT COMPANY:
**Shell Oil Products US - Mormon Island Marine Terminal**

ADDRESS:
**20945 S. Wilmington Avenue**

CITY:
**Carson, CA 90810**

TELEPHONE: **(805) 764-6004** FAX: **(310) 816-2147** E-MAIL: Elliott.Ripley@shell.com

SITE ADDRESS (Street and City):
**Shell Mormon Island Marine Terminal**
**167 Berth (167-169), Wilmington, California 90744**

**Individual NPDES Permit No. CA0064637**
**Order No. R4-2017-0039**

PROJECT CONTACT (Report to): **Elliott Ripley (805) 764-6004**

CONSULTANT PROJECT NO.:

SAMPLER NAME(S) (Print):

*LAB USE ONLY*

TURNAROUND TIME (BUSINESS DAYS):
☐ 10 DAYS ☑ 5 DAYS ☐ 72 HOURS ☐ 48 HOURS ☐ 24 HOURS ☐ LESS THAN 24 HOURS

☑ NPDES PERMIT FORMAT _____

SPECIAL INSTRUCTIONS OR NOTES: TEMPERATURE ON RECEIPT C°

**Report all methods to MDLs / Multiple dilutions for low RLs**
**EPA 8270- Use 2L for extraction (report DF=0.5x)**
**EPA 8081- low level ML (use Marine RLs)**

FAX RESULTS TO THE SHELL DISTRIBUTION LIST

**REQUESTED ANALYSIS**

| LAB USE ONLY | Field Sample Identification | SAMPLING DATE | SAMPLING TIME | MATRIX | NO. OF CONT. | Pesticides | Total Suspended Solids | Metals: Copper, Lead, and Zinc | PCBs | Salinity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Monitoring Station 02 | | | Aq. | | X | X | X | X | X |
| | Monitoring Station 03 | | | Aq. | | X | X | X | X | X |
| | Monitoring Station 04 | | | Aq. | | X | X | X | X | X |
| | Monitoring Station 05 | | | Aq. | | X | X | X | X | X |
| | Monitoring Station 06 | | | Aq. | | X | X | X | X | X |

E-mail Results to
Elliott Ripley: elliott.ripley@shell.com
Chelsea Dreyer, WGR: cdreyer@wgr-sw.com

NOTE: ALL QA/QC ITEMS MUST BE RUN ON THE SAME DATES THE SAMPLES WERE ACTUALLY ANALYZED.

REPORT ALL APPLICABLE MDLs AND RLs FOR ALL ANALYZED PARAMETERS

FIELD MEASUREMENTS RECORDED IN SEPARATE FIELD COLLECTION DATA SHEET

**Time Samples Placed on Ice:**

| Relinquished by: (Signature) | Received by: (Signature) | Date: | Time: |
|---|---|---|---|
| Relinquished by: (Signature) | Received by: (Signature) | Date: | Time: |
| Relinquished by: (Signature) | Received by: (Signature) | Date: | Time: |

LAST REVISED: 8/29/18

# Shell Oil Products US Chain Of Custody Record

Eurofins
7440 Lincoln Way
Garden Grove, CA 92841-1432
(714) 895-5494 (714) 894-7501 fax

**Shell Representative to be invoiced:**
Shell Oil Products US
Attention: Rick Roper
20945 S. Wilmington Avenue
Carson, CA 90810
(310) 816-2060

**COC MI-Sediment**
**Harbor Toxics TMDL Monitoring Program**

DATE: _____

PAGE: ____1____ of ___2____

CONSULTANT COMPANY:
**Shell Oil Products US - Mormon Island Marine Terminal**

ADDRESS:
**20945 S. Wilmington Avenue**

CITY:
**Carson, CA 90810**

TELEPHONE: **(805) 764-6004** FAX: **(310) 816-2147** E-MAIL: Elliott.Ripley@shell.com

SITE ADDRESS (Street and City):
**Shell Mormon Island Marine Terminal**
**167 Berth (167-169), Wilmington, California 90744**

**Individual NPDES Permit No. CA0064637**
**Order No. R4-2017-0039**

PROJECT CONTACT (Report to): **Elliott Ripley (805) 764-6004**

CONSULTANT PROJECT NO.:

SAMPLER NAME(S) (Print):

*LAB USE ONLY*

TURNAROUND TIME (BUSINESS DAYS):
☐ 10 DAYS ☑ 5 DAYS ☐ 72 HOURS ☐ 48 HOURS ☐ 24 HOURS ☐ LESS THAN 24 HOURS

☑ NPDES PERMIT FORMAT _____

**SPECIAL INSTRUCTIONS OR NOTES:**

TEMPERATURE ON RECEIPT C°

Report all methods to MDLs / Multiple dilutions for low RLs
EPA 8270- Use 2L for extraction (report DF=0.5x)
EPA 8081- low level ML (use Marine RLs)

FAX RESULTS TO THE SHELL DISTRIBUTION LIST

**REQUESTED ANALYSIS**

| LAB USE ONLY | Field Sample Identification | SAMPLING DATE | SAMPLING TIME | MATRIX | NO. OF CONT. | Total Organic Carbon | Metals* | PAHs* | Pesticidies* | PCBs* | Benthic Community Effect | Sediment Toxicity | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Monitoring Station 04 | | | Sediment | | X | X | X | X | X | X | X | |
| | Monitoring Station 06 | | | Sediment | | X | X | X | X | X | X | X | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

FIELD MEASUREMENTS RECORDED IN SEPARATE FIELD COLLECTION DATA SHEET

Time Samples Placed on Ice:

E-mail Results to
Elliott Ripley: elliott.ripley@shell.com
Chelsea Dreyer, WGR: cdreyer@wgr-sw.com

NOTE:
* - CONSTITUENTS REQUIRED LISTED IN ATTACHMENT A OF SQO PART 1 (PAGE 2 OF COC)

ALL QA/QC ITEMS MUST BE RUN ON THE SAME DATES THE SAMPLES WERE ACTUALLY ANALYZED.

REPORT ALL APPLICABLE MDLs AND RLs FOR ALL ANALYZED PARAMETERS

| Relinquished by: (Signature) | Received by: (Signature) | Date: | Time: |
|---|---|---|---|
| Relinquished by: (Signature) | Received by: (Signature) | Date: | Time: |
| Relinquished by: (Signature) | Received by: (Signature) | Date: | Time: |

LAST REVISED: 8/29/18

Sediment

MI-Harbor Toxics TMDL Storm Water COCs (REVISED)

# Shell Oil Products US Chain Of Custody Record

Eurofins
7440 Lincoln Way
Garden Grove, CA 92841-1432
(714) 895-5494 (714) 894-7501 fax

**Shell Representative to be invoiced:**
Shell Oil Products US
Attention: Rick Roper
20945 S. Wilmington Avenue
Carson, CA 90810
(310) 816-2060

**COC MI-Fish Tissue**
**Harbor Toxics TMDL Monitoring Program**

DATE: _____

PAGE: ____1____ of ___1____

CONSULTANT COMPANY:
**Shell Oil Products US - Mormon Island Marine Terminal**

ADDRESS:
**20945 S. Wilmington Avenue**

CITY:
**Carson, CA 90810**

TELEPHONE: **(805) 764-6004** FAX: **(310) 816-2147** E-MAIL: Elliott.Ripley@shell.com

**SITE ADDRESS (Street and City):**
**Shell Mormon Island Marine Terminal**
**167 Berth (167-169), Wilmington, California 90744**

**Individual NPDES Permit No. CA0064637**
**Order No. R4-2017-0039**

PROJECT CONTACT (Report to): **Elliott Ripley (805) 764-6004**

CONSULTANT PROJECT NO.:

SAMPLER NAME(S) (Print):

*LAB USE ONLY*

TURNAROUND TIME (BUSINESS DAYS):
☐ 10 DAYS ☑ 5 DAYS ☐ 72 HOURS ☐ 48 HOURS ☐ 24 HOURS ☐ LESS THAN 24 HOURS

☑ NPDES PERMIT FORMAT _____

**REQUESTED ANALYSIS**

**SPECIAL INSTRUCTIONS OR NOTES:** TEMPERATURE ON RECEIPT C°

Report all methods to MDLs / Multiple dilutions for low RLs
EPA 8270- Use 2L for extraction (report DF=0.5x)
EPA 8081- low level ML (use Marine RLs)

FAX RESULTS TO THE SHELL DISTRIBUTION LIST

| LAB USE ONLY | Field Sample Identification | SAMPLING DATE | SAMPLING TIME | MATRIX | NO. OF CONT. | Chlordane | Dieldrin | Toxaphene | DDT | PCBs | | | | | | | | | | | | | | | | | | | | FIELD MEASUREMENTS RECORDED IN SEPARATE FIELD COLLECTION DATA SHEET |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Time Samples Placed on Ice: |
| | Monitoring Station 07 | | | Tissue | | X | X | X | X | X | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | E-mail Results to<br>Elliott Ripley: elliott.ripley@shell.com<br>Chelsea Dreyer, WGR: cdreyer@wgr-sw.com | | | | | NOTE: ALL QA/QC ITEMS MUST BE RUN ON THE SAME DATES THE SAMPLES WERE ACTUALLY ANALYZED.<br><br>REPORT ALL APPLICABLE MDLs AND RLs FOR ALL ANALYZED | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Relinquished by: (Signature) | Received by: (Signature) | Date: | Time: |
| Relinquished by: (Signature) | Received by: (Signature) | Date: | Time: |

LAST REVISED 8/29/18

Tissue

MI-Harbor Toxics TMDL Storm Water COCs (REVISED)

# APPENDIX E:

# FIELD MONITORING FORMS

# HARBOR TOXICS TMDL FIELD COLLECTION DATA SHEET

| | | | |
|---|---|---|---|
| **StationID:** | **Date (mm/dd/yyyy):** | **SampleTime (1st sample):** | **Sampled By:** |
| **Station Location:** | **Arrival Time:** / **Departure Time:** | **Form of preservation:** ice other : _____ | |
| **Purpose (circle applicable):** Water Chemistry / TSS Sediment Fish Tissue | | **Time placed on ice / preserved:** | |

| | | | |
|---|---|---|---|
| **Location:** | **GPS/DGPS** | **Lat (dd.ddddd)** | **Long (ddd.ddddd)** |
| **GPS Device:** | **Target:** | | - |
| **Accuracy ( ft / m ):** | **Actual:** | | - |

**Additional Sample Preservation Notes:**

## FIELD OBSERVATIONS (CIRCLE ALL THAT APPLIES)

| | | |
|---|---|---|
| **WATER ODOR** | None Sewage Petroleum<br>Sulfides Mixed Other_____ | **WIND DIRECTION:** |
| **SKY COVER:** | Clear Partly Cloudy Overcast Fog<br>Smoky Hazy Other:_____ | **PRECIPITATION:** None Fog Drizzle Rain Snow |
| **OTHER PRESENCE:** | Floating and Suspended Materials Oily Sheen Turbidity<br>Odor Foam Trash Discoloration<br>Other_____ | **Precipitation Amount: (last 24 hours)** inches<br>**WATER CLARITY:** Clear Cloudy Murky |
| **WATERCOLOR:** | Colorless Green Yellow Brown Other: _____ | |

## FIELD MEASUREMENTS:

| Type of Sample: | Sample Type | Flow | Water Temp (°F) | pH (S.U.) | Dissolved Oxygen (mg/L or %) | Salinity (ppt) | Depth (m) | Equipment Decontaminated: |
|---|---|---|---|---|---|---|---|---|
| Water Column Samples | | | | | | | | ☐ Yes |
| TSS Samples | | | | | | | | ☐ Yes |
| Sediment Samples | | | | | | | | ☐ Yes |

## CALIBRATION INFORMATION:

| Instrument Type: | Flow | Temp. | pH | Dissolved Oxygen | Salinity | Notes: |
|---|---|---|---|---|---|---|
| Instrument: | | | | | | |
| Calibration Date: | | | | | | |
| Calibration Standards | | | | | | |
| Calibration Readings | | | | | | |

## FIELD STAFF CONFIRMATION OF FIELD DATA SHEET

My signature below certifies that I have reviewed the information recorded in this Field Collection Data Sheet and determined it to be complete:

| | |
|---|---|
| Date / Time Reviewed: | Signature |
| Name: | |
| Title: | |

# APPENDIX F:

# SWAMP COLLECTION OF WATER AND BED SEDIMENT WITH ASSOCIATED FIELD MEASUREMENTS AND PHYSICAL HABITAT IN CALIFORNIA

# Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California.Version 1.1 updated March-2014

The SOPs below are for reference and information purposes only, the documents are recommended, not required by the Surface Water Ambient Monitoring Program (SWAMP). Please see the SWAMP Quality Assurance Program Plan at: http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for more information regarding SWAMP QA/QC requirements.

## Table of Contents

# Acknowledgements:


This procedure has been modified from the Texas Natural Resources Conservation Commission's Procedure Manual for Surface Water Quality Monitoring, with major input from the United State's Geological Survey's (USGS's) National Water Quality Assessment (NAWQA) Protocol for Collection of Stream Water Samples, for which due credit is here with given.

The current version of these protocols was written by Sean Mundell (Moss Landing Marine Labs MPSL Field Sampling Team) with most of the credit to Max Puckett (CDFW) for originally writing this document for part of the original SWAMP QAMP, 2001. Significant contributions also came from Eric von der Geest and the (SWAMP) Quality Assurance (QA) Team, The SWAMP Data Management Team(DMT), Billy Jakl(MPSL), Mary Hamilton (RWQCB 3), and Bettina Sohst(former MPSL employee),

# Field Measurements

## Field Data Sheets

Field data sheets are used to record field observations, probe measurements, and water and sediment chemistry sampling. Field data sheets are provided on the SWAMP Data Management Resources Website at: Water Quality Field Data Sheet *(updated 12/18/12).*

There are guidelines provided below to standardize what is recorded on all data sheets and that should be helpful in completing each form. The entries discussed below and on the field data sheets are recorded at each sampling site.

# Notes to Standardize SWAMP Field Data Sheets (For in the field use)

### KEY REMINDERS to IDENTIFY SAMPLES:

1. **SAMPLE TIME** is the SAME for all samples (Water, Sediment, & Probe) taken at the sampling event. Use time of FIRST sample; important for COC (is used for identification of sample).
2. **LEFT BANK/RIGHT BANK**
   *Left bank* is defined as the bank to the left of the observer when facing downstream, and the *right bank* is to the right of the observer when facing downstream
3. **GROUP;** many different ways to do a group, one suggestion is to create groups which assign trips to assess frequency of field QA

### COLLECTION DETAILS:

1. **PERSONELL**: S. Mundell, G Ichikawa (first person listed is crew leader)
2. **LOCATION:** Bank, Thalweg, Mid-Channel, Open Water**.** Use "open water" in bay/estuary/harbor only if no distinguishable channel exists
3. **GRAB vs. INTEGRATED**: GRAB samples are when bottles are filled from a single depth; INTEGRATED sample are taken from MULTIPLE depths/grabs and combined.
   **A.** GRAB: use 0.1 for subsurface samples; if too shallow to submerge bottle; depth = 0
   **B.** INTEGRATED: -88 in depth sampled, record depths combined in sample comments
4. **TARGET LAT/LONG**: Refers to the existing station location that the sampling crew is trying to achieve; can be filled out prior to sampling
5. **ACTUAL LAT/ LONG**: is the location of the current sample event.
6. **HYDROMODIFICATION:** Describe existing hydro modifications such as a grade control, drainage pipes, bridge, culvert
7. **HYDROMOD LOC**: if there is an IMMEDIATE (with in range potentially effecting sample) hydro modification; Is the hydro modification upstream/downstream/within area of sample; if there is no hydro modification, NA is appropriate
8. **STREAM WIDTH and DEPTH**: describe in meters at point of sample.

### FIELD OBSERVATIONS: (each one of these observations has a comment field in the database so use comment space on data sheet to add information about an observation if necessary)

1. **PICTURES:** use space to record picture numbers given by camera; be sure to rename accordingly back in the office. (StationCode_yyyy_mm_dd_unique code)
2. **WADEABILITY**: in general, is water body being sampled wadeable to the average person AT the POINT of SAMPLE
3. **DOMINANT SUBSTRATE**: if possible; describe DOMINANT substrate type; use UNK if you cannot see the dominant substrate type
4. **BEAUFORT SCALE**: use scale 0-12; refer to scales listed on page 28
5. **WIND DIRECTION**: records the direction from which the wind is blowing
6. **OTHER PRESENCE**: VASCULAR refers to terrestrial plants or submerged aquatic vegetation

(SAV) and NONVASCULAR refers to plankton, periphyton etc. These definitions apply to vegetation IN the water at the immediate sampling area.

7. **OBSERVED FLOW**: Visual estimates of flow range in cubic feet/second. Flow should be recorded even if flow is visible but not measurable on that sampling visit. This is an observational measurement that is highly dependent on the knowledge of monitoring personnel.
8. **WATER COLOR**: This is the color of the water from standing creek side
9. **WATER CLARITY**: this describes the clarity of the water while standing creek side; clear represents water that is clear to the bottom, cloudy may not be clear to bottom but greater than 4 inches can be seen through the water column.
10. **PRECIPITATION LAST24hrs:** refers to field crew's best categorization of rainfall in the last 24 hrs; may or may not effect Overland Runoff Last 24 hrs
11. **OVERLAND RUNOFF LAST 24 hrs**: Significant precipitation is defined as any amount that visibly influences water quality. Light Precipitation = fog, drizzle, and/or light rain with no overland runoff; Mod to Heavy Precipitation = rain such that site probably or definitely received at least some overland runoff.
12. **SEDIMENT COMP**: generally described sediments used for chemistry sample Note: these reminders do not give all details needed to maintain equivalent SWAMP sampling protocols, they are strictly for "infield" use to help insure comparability of field observations.
13. **WATER APPEARANCE:** Note general appearance (e.g., color, unusual amount of suspended matter, debris or foam)
14. **SEDIMENT APPEARANCE** Color, Odor and sediment composition should be noted.
15. **WEATHER:** Note recent meteorological events that may have impacted water quality; (e.g., heavy rains, cold front, very dry, very wet)
16. **BIOLOGICAL ACTIVITY:** Note excessive macrophyte, phytoplankton or periphyton growth. The observation of water color and excessive algal growth is very important in explaining high chlorophyll a values. Other observations such as presence of fish, birds and spawning fish are noted.
17. **WATERSHED or INSTREAM ACTIVITIES:** Note in stream or drainage basin activities or events that is impacting water quality (e.g., bridge construction, shoreline mowing, livestock watering upstream).
18. **RECORD of PERTINENT OBSERVATIONS RELATED to WATER QUALITY and STREAM USES:** If the water quality conditions are exceptionally poor, note that standards are not met in the observations, (e.g., dissolved oxygen is below minimum criteria). Note uses (e.g., swimming, wading, boating, fishing, irrigation pumps, navigation). Eventually, for setting water quality standards, the level of use will be based on comments related to the level of fishing and swimming activities observed at a station.
19. **SPECIFIC SAMPLE INFORMATION:** Note specific comments about the sample itself that may be useful in interpreting the results of the analysis (e.g., number of sediment grabs, or type and number of fish in a tissue sample). If the sample was collected for a complaint or fish kill, make a note of this in the observation section.
20. **MISSING PARAMETERS:** If a scheduled parameter or group of parameters is not collected, make some note of this in the comments.
21. **RECORD of DATA SUBMISSION:** Initials and date are recorded on the field data sheet showing a record that the data has been transcribed onto data forms and submitted to the SWAMP data management staff.

## Record of Samples Collected for Purposes of Chemical Analysis

The general types of chemical samples to be collected are listed for each site, since this may vary from site-to-site (e.g., metals-in-water, pesticides-in-sediments, conventional water quality). Analyses authorization forms are recommended since different authorized laboratories perform different chemical analyses. The method of preservation for each chemical sample is recorded, as appropriate on the Chain of Custody Form (COC).

## Field Data Measurements

While collecting water samples (see Field Collection Procedures for Water Samples page 29), record appropriate field measurements. When field measurements are made with a multi-parameter instrument, it is preferable to place the sonde in the body of water to be sampled and allow the dissolved oxygen (D.O.) to equilibrate. D.O. usually takes the longest to equilibrate out of the probe measurements (pH, Temperature, Conductivity and Turbidity) Field measurements are made at the centroid of flow, if the stream visually appears to be completely mixed from shore to shore. *Centroid* is defined as the midpoint of that portion of the stream width which contains 50% of the total flow. Probe measurements and water sampling are best to collect in the stream location that best represents the entire stream. For routine field measurements, the date, time and depth are reported as a grab. Quality control requirements for field measurements are listed in Quality Control and Sample Handling Tables for Field Measurements in Fresh and Marine Water.

## Recommended Depths for Conducting Field Data Measurements

**Water Depth Less than 5 ft (<1.5 m)**

If the water depth is less than 5 ft (1.5 m), grab samples for water are taken at approximately 0.1 m (4 in.), and multi-probe measurements are taken at approximately 0.2 m (8 in.). This is because all sensors have to be submerged, so 0.1 m would not be deep enough. But taking a grab sample at 0.2 m is not always feasible, as it is difficult to submerge bottles to that depth, and in many cases the bottle will hit the stream bottom.

**Water Depth Greater than 5 ft (>1.5 m)**

If the water depth at the sampling point exceeds 5 ft (1.5 m) in depth, a vertical profile of dissolved oxygen, temperature, pH and specific conductance are made using the multi-parameter probe equipment. The depth of the sonde at the time of measurement is most accurately determined from the depth sensor on the multi-parameter sonde rather than depth labels on the cable.

**Vertical Depth Profiles and Depth-Integrated Sample Collection**

If depth integration sampling is being conducted, or if vertical profile measurements are requested, multi-probe measurements are made starting at a depth of 0.2 m, and are then conducted at 1.0, 2.0, 3.0, 4.0, and 5.0 m depths after that until 5.0 m depth is reached. Beginning at 5.0 m, measurements are made every 5.0 m through depth profile.

Field data for multi-parameter vertical depth profiles are recorded in final form on the SWAMP Field Data Sheets and submitted to the SWAMP data management staff. Go to http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for detailed information on data reporting.

## Water Temperature ($^{O}$C)

Water temperature data are recorded for each site visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff.

### Temperature Sampling Procedures

Temperature is measured in-stream at the depth(s) specified above. Measuring temperature directly from the stream by immersing a multi-probe instrument or thermometer is preferred.

### Hand Held Centigrade Thermometer

If an electronic meter is not available, the temperature is measured with a hand-held, centigrade thermometer (Rawson, 1982).

- In wadeable streams, stand so that a shadow is cast upon the site for temperature measurement.
- Hold the thermometer by its top and immerse it in the water. Position the thermometer so that the scale can be read.
- Allow the thermometer to stabilize for at least one minute, then without removing the thermometer from the water, read the temperature to the nearest $0.1^{o}$ C and record.
- Do not read temperature with the thermometer out of the water. Temperature readings made with modern digital instruments are accurate to within $\pm$ $0.1^{o}$ C.

### Temperature Measurement from a Bucket

When temperature cannot be measured in-stream, it can be measured in a bucket-Nalgene or plastic container. Care must be taken to insure a measurement representative of in-stream conditions.

The following conditions must be met when measuring temperature from a bucket:

- The bucket must be large enough to allow full immersion of the probe or thermometer.
- The bucket must be brought to the same temperature as the water before it is filled.
- The probe must be placed in the bucket immediately, before the temperature changes.
- The bucket must be shaded from direct sunlight and strong breezes prior to and during temperature measurement.
- The probe is allowed to equilibrate for at least one minute before temperature is recorded.
- After these measurements are made, this water is discarded and another sample is drawn for water samples which are sent to the laboratory.

## pH (standard units)

pH data is recorded for each SWAMP visit in final form on the Field Data Sheets and submitted to the SWAMP data management staff. Go to http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for detailed information on data reporting.

### pH Sampling Equipment

The pH meter should be calibrated according to the recommended procedures for calibration and maintenance of SWAMP field equipment. Calibration directions are listed in the manufactures field equipment operations manual. The pH function is pre and post calibrated every 24 h of use for multi-parameter instruments.

### pH Sampling Procedures

### In-stream Method

Preferably, pH is measured directly in-stream at the depth(s) specified earlier in this document. Allow the pH probe to equilibrate for at least one minute before pH is recorded to the nearest 0.1 pH unit.

### pH Measurement from a Bucket

When pH cannot be measured in-stream, it can be measured in a bucket-Nalgene or plastic container. The following precautions are outlined above; "Temperature Measurement from a Bucket".

### Potential Problems

- If the pH meter value does not stabilize in several minutes, out gassing of carbon dioxide or hydrogen sulfide, or the settling of charged clay particles may be occurring (Rawson, 1982).
- If out gassing is suspected as the cause of meter drift, collect a fresh sample, immerse the pH probe and read pH at one minute.
- If suspended clay particles are the suspected cause of meter drift, allow the sample to settle for 10 min, then read the pH in the upper layer of sample without agitating the sample.
- With care, pH measurements can be accurately measured to the nearest 0.1 pH unit.

## Dissolved Oxygen (mg/L)

Dissolved oxygen (D.O.) data is recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff.
See http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for detailed information on data reporting.

### Dissolved Oxygen Sampling Equipment

The dissolved oxygen meter should be calibrated according to the recommended procedures for calibration and maintenance of SWAMP field equipment. Calibration directions are listed in the manufactures field equipment operations manual.

### Multi-probe Instrument

Pre and post calibrate the D.O. sensor every 24 h and for elevations greater than 500 ft on the multi-probe instrument. Preferably, D.O. is measured directly in-stream at the depth(s) specified in the Field Measurements section above. The D.O. probe must equilibrate for at least 90 s before D.O. is recorded to the nearest 0.1 % saturation or mg/L. Care must be taken at profile stations to insure that the reading is stable for each depth. Since dissolved oxygen takes the longest to stabilize, record this parameter after temperature, conductivity and pH. If the D.O. probe has an operable, automatic stirrer attached, the D.O. probe does not have to be manually stirred. However, if the probe is not equipped with an automatic stirrer, manual stirring must be provided by raising and lowering the probe at a rate of 1 ft/s (0.3m/s) without agitating the water surface. If the stream velocity at the sampling point exceeds 1 ft/s, the probe membrane can be pointed upstream into the flow and manual stirring can be avoided (Rawson, 1982).

### D.O. Measurement from a Bucket

When D.O. cannot be measured in-stream, it can be measured in a bucket-Nalgene or plastic container, following precautions outlined in the Temperature Measurement from a Bucket listed above. During equilibration and reading, water should be moved past the membrane surface at a velocity of 1 ft/s (0.3 m/sec), either by automatic stirrer or manual stirring. If stirred manually in a bucket, the water surface is not agitated (Rawson, 1982).

## 24-Hour Average D.O. Continuous Monitoring (if requested in special study)

## Unattended 24-Hour D.O. Data Collection

### Why Collect 24-Hour Data

Dissolved oxygen sampling for standards compliance is targeted to water bodies where low instantaneous D.O. levels indicate partial or nonsupport of designated aquatic life uses. Intensive monitoring is conducted with automated equipment that is preset to record and store field measurements hourly over one 24-h period. Four or more dissolved oxygen measurements may also be made manually at 4-6-h intervals over one 24-h period, as long as one is made near sunrise (0500-0900 h) to approximate the daily minimum. However, data collected with automated equipment is preferred.

### When to Take Measurements

All 24-h D.O. monitoring events must be spaced over an index period representing warm-weather seasons of the year (approx March 15-October 15), with between one-half to two-thirds of the measurements occurring during the critical period (July 1-September 30). The ***critical period*** of the year is when minimum stream flows, maximum temperatures, and minimum dissolved oxygen concentrations typically occur in area streams. **A flow measurement must be taken at the time of deployment.** In a perennial stream, a 24-h data for standards compliance can not be used if the flow is less than the 7Q2. In perennial streams, the D.O. criterion to do not

apply for flows under the 7Q2. A period of about one month must separate each 24-h sampling event. Additional samples may be collected outside the index period to further characterize a water body, but that information is generally not used for assessing standards compliance.

**Frequency of Measurements**

The measurement interval should be no more than once per 15 min and no less than once per hour.

**Where to Take Measurements**

For purposes of determining standards compliance with the 24-h average criteria, samples collected near the surface will be considered representative of the mixed surface layer. In deep streams, reservoirs, and tidally influenced water bodies, automated equipment is positioned between 1 foot (from the surface) to one-half the depth of the mixed surface layer. At least 10 24-h monitoring events (using the 24-h criteria and/or absolute minimum criteria) at each site within a 5-year period are recommended to provide adequate data for assessment.

**When to Collect Other Routine Samples, if doing 24-hour D.O. measurements**

Other routine field measurements and water samples should be collect at either the time of deployment, at the reference check, or when the multi-probe recording 24-h data is retrieved. When ever possible, flow must be measured at the 24-h site.

**Priority for Scheduling 24-Hour Sampling Events**

- < 303d listed waterbodies
- < Waterbodies with Concerns for DO problems (too few samples available for full use assessment).
- < Occurrence of low D.O. concentrations observed during the day
- < Waterbodies with trends indicating declining D.O. concentrations
- < Waterbodies which would contribute to an Eco-region data set

**Data Reporting for 24-hour D.O. measurements**

Dissolved oxygen values recorded over the 24-h period are summed and divided by the number of measurements to determine the average concentration, which is compared to the 24-h criterion. The lowest D.O. value from each 24-h set is compared to the minimum criterion. There will be occasions when a complete 24-h data set won't be possible. For example, if there are 18 measurements instead of 24, a time weighted diurnal average needs to be calculated. This can be easily done using GW Basic.

Support of assigned aquatic life use is based on 24-h D.O. average and minimum criteria for each monitoring event. Report the 24-h average D.O. value, number of measurements over a 24-h period, and the minimum, and maximum values. Report data as a time composite sample with a beginning and ending date and time, covering the 24-h period measured.

# Specific Conductance (µS/cm)

Specific conductance should be recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff.
See http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for detailed information on data reporting.

**Specific Conductance Sampling Equipment**

The conductivity meter should be calibrated according to the recommended procedures for calibration and maintenance of SWAMP field equipment. Calibration directions are listed in the manufactures field equipment operations manual.

**Specific Conductance Sampling Procedure**

Preferably, conductivity is measured directly in-stream at the depth(s) specified earlier in this document. Allow the conductivity probe to equilibrate for at least one minute before specific conductance is recorded to three significant figures (if the value exceeds 100). The primary physical problem in using a specific conductance meter is entrapment of air in the conductivity probe chambers. The presence of air in the probe is indicated by unstable specific conductance values fluctuating up to +/-100 µS/cm. The entrainment of air can be minimized by slowly, carefully placing the probe into the water; and when the probe is completely submerged, quickly move it through the water to release any air bubbles.

If specific conductance cannot be measured in-stream, it should be measured in the container it can be measured in a bucket-Nalgene or plastic container. The following precautions are outlined above; "Temperature Measurement from a Bucket".

**Salinity (parts per thousand--ppt, or ‰)**

The value for salinity is computed from chloride concentration or specific conductance. The calculation assumes a nearly constant ratio for major ions in an estuary when seawater is diluted by river water. This assumption does not hold for cases where salinity is less than about three parts per thousand. Salinity determinations at such low values are only approximate. In estuarine waters, salinity is a relevant and meaningful parameter. Often the salinity may be low, approaching that of freshwater. Nevertheless, this is useful information. Determine if a station is estuarine from historical records (i.e., experiences cases where salinity is >2.0 ppt) and always report salinity at this station, regardless of the salinity during periods of high flow.

Salinity is measured directly in-stream at the depth(s) specified earlier in this document. Salinity data should be recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff. See http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for detailed information on data reporting.

Values between 2.0 ppt and 1.0 ppt should be reported as <2.0 ppt rather than the actual value and values <1.0 ppt should be reported as <1.0 ppt. The field instruments compute salinity from specific conductance and temperature, and display the value in parts per thousand. Report salinity values above 2.0 ppt to the nearest 0.1 ppt.

# Secchi Disc Transparency (meters)--if requested in special study

Secchi disk transparency should be recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff. See http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for detailed information on data reporting.

Secchi Disk Sampling Equipment

- < Secchi disk, 20 cm in diameter
- < Measuring tape

### Secchi Disk Transparency Sampling Procedures

Preferably, Secchi disk transparency is measured directly in-stream wherever conditions allow. The Secchi disk should be clean, weighted and suspended with chain, wire, or Dacron line (the line used to suspend the Secchi disk should not be nylon or cotton; stretching may cause erroneous readings). Another option is to attach the Secchi disk to a metal rod calibrated in metric units.

**Average Turbidity**

The Secchi disk should be lowered vertically in a location shielded from direct sunlight. Glare from the water's surface will affect the accuracy of the measurement. Don't wear sunglasses.

Slowly lower the disk until it disappears from view. The person viewing the disk should maintain an eye level of less than two meters above the water's surface. Note the depth at which the disk disappears from view.

Slowly raise the disk until it becomes visible. Note the depth at which the disk reappears.

Compute the mathematical average of the two depths noted and record the average value to two significant figures on the field data sheet. The recorded average value is the Secchi disk transparency.

**High Turbidity (Muddy Water)**

In streams with very high turbidity, high velocity, and/or poor access, it may be necessary to measure Secchi disk transparency in a bucket. Fill the bucket from the centroid of flow being careful not to disturb the substrate.

Follow steps above for measuring the Secchi disk depth within 30 s after raising the filled bucket from the water's surface. Or, re-suspend the solids by stirring, then quickly make the measurement.

Record Secchi disk transparency to two significant figures.

**Low Turbidity (Clear Water)**

Some bodies of water will be so clear and shallow that it will not be possible to lower the Secchi disk until it disappears from view.

Measure and record the depth at the deepest point accessible. Report Secchi disk transparency as greater than the deepest depth measured.

*Example (Low Turbidity)*: South Fork Rocky Creek is a small (<1 $ft^3/s$) clear stream. The stream in the vicinity of the sampling site was less than 1 m deep and the bottom was clearly visible everywhere. However, a pool was located in the stream next to a bridge. The maximum depth of the pool was 2.6 m at which depth the Secchi disk was still visible. Therefore, Secchi disk transparency for South Fork Rocky Creek was recorded as > 2.6 m.

**Importance of Secchi Disk Data**

Eutrophication, the natural aging process in reservoirs and lakes is accelerated by human activities which add nutrients to lakes, reservoirs, and the surrounding watersheds. Section 314 of the Clean Water Act (CWA) of 1987 requires all states to classify lakes and reservoirs according to trophic state. Although chlorophyll a is the most direct measure of algal biomass, other indices and programs utilize Secchi disk depth as the primary factor.

## Turbidity Measurement with Turbidity Meter

Nephelometric Turbidity (turbidity standard unit is called Nephelometric Turbidity Units (NTU)) can be determined by measuring the amount of scatter when light is passed through a sample using a turbidity meter. The LaMotte 2020 Turbidity meter is a suitable instrument for example. There are also turbid-ometers attached to multi-probe instruments like YSI or Hydro-Lab.

Turbidity meters should be calibrated using a standard close to the expected sample value. Calibration standards should be used that are relative to the suspended sediment particles in the sampleable water column. Typical calibration standard values are 1, 10, 100, and 1000 NTU's.

For instructions on how to operate the instruments refer to the manufacturer's manual. Turbidity measurements can be executed together with water sampling. The turbidity sample has to be representative for the sampled water mass. Make sure that no gas bubbles are trapped in the vial for the reading and that the outside of the vial is wiped completely clean (i.e., meaning free of moisture, lint and fingerprints). Take several measurements to assure an accurate reading. Do not record values that vary greatly. If variations are small, record an average. If settling particles are present, record a reading before and one after settling. The meter might have to be recalibrated with a different standard, if the sample water readings are outside of the calibration standard limits.

## Flow

Sampling crews should be notified on reconnaissance forms if it is known that there is an operational United States Geological Survey (USGS) gage located at or nearby a sampling site. If there is a USGS gage nearby, a gage height in feet is recorded and later converted to an instantaneous flow value and recorded on the field data sheet. The gage height is always to be reported to the USGS for conversion to flow. If a USGS gage is not available, a flow measurement should be taken, if requested. See Instantaneous Flow Measurement information starting on page 13 in this document. Centroid velocity measurements may also be taken as a minimum acceptable rough characterization of the stream flow as requested, although this measurement is not to be recorded as a flow, since it is only a velocity measurement
Flow information for over 200 USGS sites is available on the Internet. The address is http://water.usgs.gov/index.html. This is useful information in determining flow conditions prior to sampling. This information may be included in general observations.

## Flow Measurement Method (Reporting)

The method used to measure flow is noted by reporting which instrument or gage is used. Examples are, Flow Gage Station (USGS/IBWC), Electric Marsh-McBirney flo mate 4000, Mechanical (ex. Pigmy meter), Weir/Flume, Other (orange peel, etc.) Flow data transformers are used to enter flow data into the SWAMP database. Please contact the SWAMP data management team to obtain the flow data transformer.

**Flow ($ft^3/s$)**

If requested, flow data should be recorded for each monitoring visit to non-tidal, flowing streams. Flow data should be recorded in final form on a Field Data Sheet and submitted to the SWAMP data management staff. See http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa for detailed information on data reporting. The following are two exceptions to the flow reporting requirement:

**No Flow/ Pools** — If there is no flow at a stream site and accessible, isolated pools remain in the stream bed, collect and report the required field data and laboratory samples from the pools and report instantaneous flow. Under these conditions, flow ($ft^3/s$) should be reported as zero. Pools may represent natural low-flow conditions in some streams and the chemistry of these pools will reveal natural background conditions.

**Dry** — If the stream bed holds no water, the sampling visit is finished. Report that the stream was "dry" in the observations. No value is reported for flow since there is no water.